

USSN 10/699,481

PATENT

-4-

In the Claims

Please cancel claims 1, 2, 9, 10, 13, 14, 21, 23, 27, 29 and 30 and add new claims 31-

43. The claims currently pending in the application are as follows:

1. (cancelled)
2. (cancelled)
3. (currently amended) The transformer of claim 2,17, in which:
the piezoelectric material has an acoustic impedance; and
the acoustic decoupling material has an acoustic impedance less than the acoustic impedance of the piezoelectric material.
4. (original) The transformer of claim 3, in which the acoustic decoupling material has an acoustic impedance intermediate between the acoustic impedance of the piezoelectric material and the acoustic impedance of air.
5. (currently amended) The transformer of claim 2,17, in which the acoustic decoupling material has an acoustic impedance in the range from about 2 Mrayl to about 16 Mrayl.
6. (currently amended) The transformer of claim 2,17, in which the acoustic decoupling material comprises plastic.
7. (currently amended) The transformer of claim 2,17, in which the acoustic decoupling material comprises polyimide.
8. (currently amended) The transformer of claim 2,17, in which the acoustic decoupling material comprises poly(para-xylylene).
9. (cancelled)

USSN 10/699,481

PATENT

-5-

10. (cancelled)

11. (currently amended) The transformer of claim ~~10~~,18 in which the Bragg structure comprises one or more low acoustic impedance Bragg elements interleaved with high acoustic impedance Bragg elements.

12. (original) The transformer of claim 11, in which two of the high acoustic impedance Bragg elements additionally serve as one of the electrodes of each of the FBARs.

13. (cancelled)

14. (cancelled)

15. (currently amended) The transformer of claim ~~14~~,22, in which:
the piezoelectric material of each of the SBARs has an acoustic impedance; and
the acoustic decoupling material has an acoustic impedance less than the acoustic impedance of the piezoelectric material.

16. (currently amended) The transformer of claim ~~14~~,22, in which the acoustic decoupling material has an acoustic impedance in the range from about 2 Mrayl to about 16 Mrayl.

USSN 10/699,481

PATENT

-6-

17. (currently amended) ~~The~~ An acoustically-coupled transformer of claim 14, in
~~which the transformer has~~ having a pass band characterized by a center frequency; and, the
transformer comprising:

5 a first stacked bulk acoustic resonator (SBAR) and a second SBAR, each SBAR
comprising:

a stacked pair of film bulk acoustic resonators (FBARs), each of the FBARs
comprising opposed planar electrodes and a layer of piezoelectric material between
the electrodes, and

10 an acoustic decoupler between the FBARs, the acoustic decoupler comprising
a layer of acoustic decoupling material having a nominal thickness equal to an
odd integral multiple of one quarter of the wavelength in the acoustic decoupling
material of an acoustic wave having a frequency equal to the center frequency;
first terminals;

15 second terminals;
a first electrical circuit connecting one of the FBARs of the first SBAR to one of the
FBARs of the second SBAR and to the first terminals, and
a second electrical circuit connecting the other of the FBARs of the first SBAR to the
other of the FBARs of the second SBAR and to the second terminals.

USSN 10/699,481

PATENT

-7-

18. (currently amended) ~~The~~ An acoustically-coupled transformer, comprising: of
~~claim 13, in which~~

a first stacked bulk acoustic resonator (SBAR) and a second SBAR, each SBAR
comprising:

5 a stacked pair of film bulk acoustic resonators (FBARs), each of the FBARs
comprising opposed planar electrodes and a layer of piezoelectric material between
the electrodes, and

an acoustic decoupler between the FBARs, the acoustic decoupler of each of
the SBARs comprisescomprising a Bragg stack;

10 first terminals;

second terminals;

a first electrical circuit connecting one of the FBARs of the first SBAR to one of the
FBARs of the second SBAR and to the first terminals, and

15 a second electrical circuit connecting the other of the FBARs of the first SBAR to the
other of the FBARs of the second SBAR and to the second terminals..

19. (original) The transformer of claim 18, in which the Bragg structure comprises
one or more low acoustic impedance Bragg elements interleaved with high acoustic
impedance Bragg elements.

20. (original) The transformer of claim 19, in which two of the high acoustic
impedance Bragg elements additionally serve as one of the electrodes of each of the FBARs.

21. (cancelled)

USSN 10/699,481

PATENT

-8-

22. (currently amended) The transformer of claim ~~21~~,17, in which:
the first electrical circuit connects the one of the FBARs of the first SBAR in one of
(a) series and (b) anti-parallel with the one of the FBARs of the second SBAR; and
the second electrical circuit connects the other of the FBARs of the first SBAR in
5 one of (c) series and (d) anti-parallel with the other of the FBARs of the second SBAR.

23. (cancelled)

24. (currently amended) The transformer of claim ~~23~~,17, in which the first terminals
constitute primary terminals and the second terminals constitute secondary terminals.

25. (original) The transformer of claim 22, in which:
the transformer additionally comprises a substrate arranged support the SBARs;
in the one of the FBARs of each the SBARs, one of the electrodes thereof is a first
electrode, the other of the electrodes thereof is a second electrode, and the first electrode is
5 closer to the substrate than the second electrode; and
the first electrical circuit comprises:
an electrical connection between the first electrode of the first SBAR and the
second electrode of the second SBAR, and
an electrical connection between the second electrode of the first SBAR and
10 the first electrode of the second SBAR.

26. (currently amended) The transformer of claim ~~24~~,17, in which:
the first electrical circuit connects the one of the FBARs of the first SBAR in one of
(a) parallel and (b) anti-series with the one of the FBARs of the second SBAR; and
the second electrical circuit connects the other of the FBARs of the first SBAR in
5 one of (c) parallel and (d) anti-series with the other of the FBARs of the second SBAR.

27. (cancelled)

USSN 10/699,481

PATENT

-9-

28. (original) The transformer of claim 26, in which the first terminals constitute primary terminals and the second terminals constitute secondary terminals.

29. (cancelled)

30. (cancelled).

31. (new) The transformer of claim 17, in which the first terminals constitute primary terminals and the second terminals constitute secondary terminals.

32. (new) The transformer of claim 17, in which:
the transformer additionally comprises a substrate arranged support the SBARs;
in the one of the FBARs of each the SBARs, one of the electrodes thereof is a first
electrode, the other of the electrodes thereof is a second electrode, and the first electrode is
5 closer to the substrate than the second electrode; and
the first electrical circuit comprises:
an electrical connection between the first electrode of the first SBAR and the
second electrode of the second SBAR, and
an electrical connection between the second electrode of the first SBAR and
10 the first electrode of the second SBAR.

33. (new) The transformer of claim 26, in which:
the piezoelectric material has an acoustic impedance; and
the acoustic decoupling material has an acoustic impedance less than the acoustic
impedance of the piezoelectric material.

34. (new) The transformer of claim 26, in which the acoustic decoupling material has
an acoustic impedance in the range from about 2 Mrayl to about 16 Mrayl.

USSN 10/699,481

PATENT

-10-

35. (new) The transformer of claim 26, in which the acoustic decoupling material comprises plastic.

36. (new) The transformer of claim 18, in which:

the first electrical circuit connects the one of the FBARs of the first SBAR in one of (a) series and (b) anti-parallel with the one of the FBARs of the second SBAR; and

the second electrical circuit connects the other of the FBARs of the first SBAR in one of (c) series and (d) anti-parallel with the other of the FBARs of the second SBAR.

37. (new) The transformer of claim 36, in which:

the transformer additionally comprises a substrate arranged support the SBARs;

in the one of the FBARs of each the SBARs, one of the electrodes thereof is a first electrode, the other of the electrodes thereof is a second electrode, and the first electrode is closer to the substrate than the second electrode; and

the first electrical circuit comprises:

an electrical connection between the first electrode of the first SBAR and the second electrode of the second SBAR, and

an electrical connection between the second electrode of the first SBAR and the first electrode of the second SBAR.

38. (new) The transformer of claim 36, in which the Bragg structure comprises one or more low acoustic impedance Bragg elements interleaved with high acoustic impedance Bragg elements.

39. (new) The transformer of claim 38, in which two of the high acoustic impedance Bragg elements additionally serve as one of the electrodes of each of the FBARs.

40. (new) The transformer of claim 18, in which:

the first electrical circuit connects the one of the FBARs of the first SBAR in one of (a) parallel and (b) anti-series with the one of the FBARs of the second SBAR; and

USSN 10/699,481

PATENT

-11-

the second electrical circuit connects the other of the FBARs of the first SBAR in
5 one of (c) parallel and (d) anti-series with the other of the FBARs of the second SBAR.

41. (new) The transformer of claim 40, in which the Bragg structure comprises one
or more low acoustic impedance Bragg elements interleaved with high acoustic impedance
Bragg elements.

42. (new) The transformer of claim 41, in which two of the high acoustic impedance
Bragg elements additionally serve as one of the electrodes of each of the FBARs.

43. (new) The transformer of claim 18, in which:
the transformer additionally comprises a substrate arranged support the SBARs;
in the one of the FBARs of each the SBARs, one of the electrodes thereof is a first
electrode, the other of the electrodes thereof is a second electrode, and the first electrode is
5 closer to the substrate than the second electrode; and
the first electrical circuit comprises:
an electrical connection between the first electrode of the first SBAR and the
second electrode of the second SBAR, and
an electrical connection between the second electrode of the first SBAR and
10 the first electrode of the second SBAR.